

fourth vein 6 times as long as penultimate section; veins 3 and 4 gradually divergent on their last sections; last section of fifth vein about one third longer than penultimate section. Length, 2 mm.

Type, Monticello, Ill., June 28, 1914 (J. R. Malloch). Taken by sweeping vegetation on bank of Saugamon River. Food plant unknown.

This species will "run down" to section 34 in the table referred to previously, but may be separated from both of the species therein by the comparative lengths of the last 2 sections of fifth vein as well as other characters. Both *isolata* Malloch and *fragariae* Malloch have the last section of the fifth vein shorter than the penultimate section.

A NEW SPECIES OF THRIPOCTENUS (Chalcidoidea).¹

BY L. T. WILLIAMS.

During an afternoon's collecting in a swampy spot near the Arnold Arboretum, Forest Hills, Mass., a few galls on willow twigs were secured and brought into the laboratory at the Bussey Institution. A casual examination on the date of their collection (July 22, 1915) showed that they contained immature insects of some sort, but no further attention was paid them until August 10, when the galls were opened and found to contain several large black thrips, and a single minute Chalcidoid parasite. Any possible doubt as to the relationship between the insects was removed when the parasite was identified by Professor Brues as belonging to the genus *Thripoctenus*, which is known to be an enemy of the Thysanoptera.

The genus *Thripoctenus* was proposed in 1911 by Crawford for a new species from California, belonging to the sub-family Tetrastichinae, and described by him under the specific name of *russelli* in honor of its discoverer, the late Mr. H. M. Russell. A second species has recently been described in Europe by Vuillet. I have not had access to this description but the differences in habitat and in the systematic positions of the hosts would indicate that the present species is perfectly distinct. The characters distinguishing it from the type species are well marked, as will be noted later.

¹ Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University, No. 112.

The following description contains certain characters of generic, rather than specific value, which are included merely for convenience in identifying specimens.

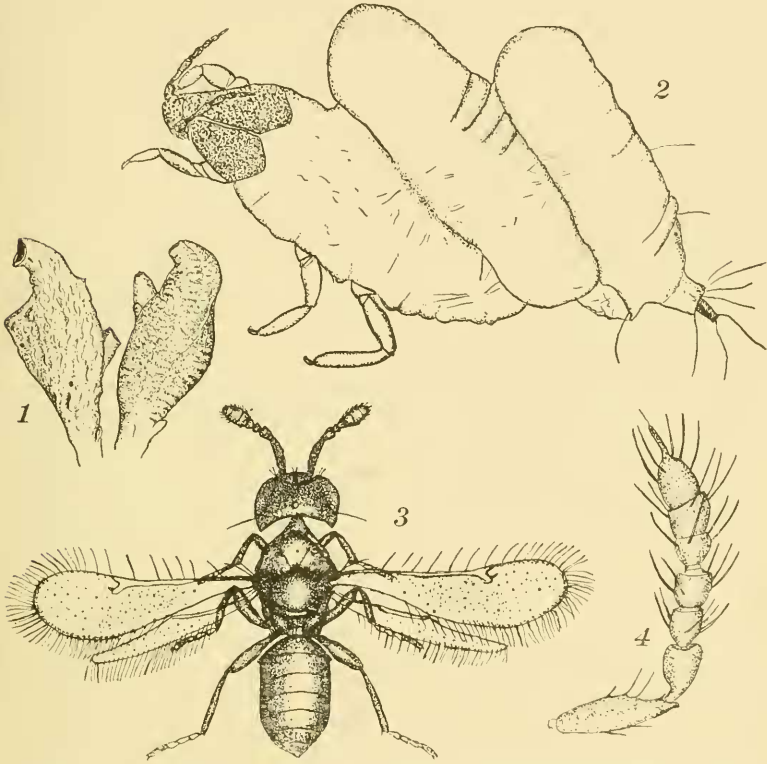


Fig. 1. 1, Willow galls occupied by thrips; 2, Parasitized thrips containing three larvæ of *Thripoctenus nubilipennis*; 3, *Thripoctenus nubilipennis* ♀; 4, Antenna of same, ♂.

Thripoctenus nubilipennis sp. nov.

Female: Length, 0.7–0.9 mm. Antennæ inserted just above the clypeus, 7-jointed, the club of 3 segments and the funicle of 2, the latter shorter than the pedicel. Head as wide or slightly wider than the thorax, seen from in front distinctly wider than long. Clypeus with a distinct keel. Front broad, strongly concave. Inner eye-margin with a row of bristles, the posterior one long and conspicuous. Ocelli in a low triangle. Genæ prominent,

well-developed. Mesonotum convex, somewhat cordate, owing to a posterior cleft or indentation. Parapsidal furrows incomplete, indistinct during life. Scutellum oval, without longitudinal furrows. Tegulae with a pair of bristles. Abdomen elongate-ovate, about as long as the thorax, laterally keeled or compressed. Ovipositor scarcely visible when at rest. Color, black, highly polished, tarsi, except for dusky terminal joints, testaceous. Antennae dark, but translucent, hence appearing yellowish when mounted; clothed with whitish hairs. Eyes very dark russet-red, almost black; ovipositor yellow, transparent. Wings with a distinct median cloud, and a marginal thickening or pigmentation extending from the end of the post-marginal vein to a point on the posterior margin opposite the stigmal vein. Wing-cilia very long, dark-colored.

Male: Smaller (on the average) than the female, abdomen slenderer more abruptly tapering. Antennae 7-jointed, as in female, but differing as follows: scape broader, pedicel shorter than the funicle, club much less marked. Joints of the flagellum with whorls of bristles. Terminal joint with a rod-like, bristle-tipped prolongation, about two-thirds as long as the joint. Color, as in female.

This species is very readily distinguished from *T. russelli* by its uniformly black color and clouded wings. The rod-like appendage of the male is very curious and distinctive, though it may pass for an ordinary bristle if not closely examined under a compound microscope. I presume that it is characteristic of the genus, though I have no means of knowing this, the male of *T. russelli* being as yet undescribed.

Habits of the Hosts.

Specimens of the thrips were sent for determination to Dr. J. D. Hood of the Biological Survey, who kindly identified them as belonging to two species, *Megalothrips spinosus* Hood and *Cryptothrips rectangularis* Hood, both members of the family Phloeothripidae. Unfortunately, the larvae of the two forms were not distinguished during the course of my observations, and it is impossible to ascertain at present whether their relations to the parasite are different, but it seems probable that either is attacked without discrimination.

After the parasite's relation to the Thysanoptera had been established the locality where the galls had been collected was re-visited, and large numbers of additional specimens secured from time to time. These galls were not, of course, the work of the thrips. They were practically all on dead wood, and may have been several seasons old. The commonest type, and that most frequented by the thrips was the one shown in Fig. 1, 1, but the insects were also found in other sorts, among them the well-known "pine-cone" willow gall. The original inhabitant of the gall is therefore of little importance, since the thrips evidently occupy any sort that will accommodate them.

The galls are not a mere temporary shelter, as all stages of the thrips from the egg to the adult were to be found in them, and none were found outside, upon the twigs. There seem to be no definite generations, all stages being obtainable at any time during the period for which they were under observation. What they eat, unless they are able to subsist on the dry wood of the gall, seems a mystery, the dead willows being the only visible source of nourishment. The other insects found in the galls are scarcely sufficient to permit of a regular carnivorous habit, although occasional cannibalism is not unlikely.

Habits of the Parasite.

The life-history of *Thripoctenus russelli* has been studied in detail by Mr. H. M. Russell of the Entomological Bureau. The writer has not been able to treat the present species so exhaustively within the time at his disposal, but the details gathered show many points of similarity between the two species as well as several interesting differences.

Oviposition: On the 16th of August no parasites had issued from the new lot of galls, and to hasten matters a number were cut open, several female parasites rewarding the search. Two or three of these were placed in a vial with an immature thrips. At first they ran around without paying any particular attention to it, but before very long one of them ran up, examined the thrips briefly with its antennæ, and then immediately thrust its abdomen forward between its legs and punctured the larva with its ovipositor. After a moment, however, it relinquished its attempt for no apparent reason. Later the same thrips was approached by a par-

asite (No. 1) which went through the preliminary motions of oviposition, but before it had completed the action another (No. 2) ran up and pierced the thrips with its ovipositor. After remaining in this position some minutes it applied its mouth to the puncture and sucked the wound for about the same length of time. Meanwhile No. 1 repeatedly brought its abdomen forward as if to oviposit, but failed to do so. Both insects immediately afterwards deposited something on the wall of the test tube, which may have been merely excrement, though in the case of No. 1 it was shaped very like the usual parasitic egg.

Subsequently, numbers of adults and pupæ of the *Thripoctenus* were obtained, and the process of oviposition was frequently witnessed. The thrips and parasites (one individual of each, as a rule) were placed on a glass slide within a ring of paraffin, and covered with a cover-slip. Under these unnatural conditions the behavior of the parasites was somewhat capricious. Their first action was almost invariably a systematic examination of their prison, out of which, if there was the smallest space between the wax and the cover they usually succeeded in forcing their way. After these efforts had been brought to a conclusion they might or might not show some interest in the thrips. Often they remained with their antennæ applied to the bodies of the larvæ, without attempting to oviposit. Under such conditions any slight movement on the part of the thrips was likely to stimulate the parasites to action. If they met with the thrips at an unfavorable angle they seldom rectified their position, but let it go. The thrips also showed some variation in their receptions of the attack. They were generally rather quiescent, but sometimes crawled about rapidly in their endeavor to escape. This was usually successful, especially if done just as oviposition commenced, but occasionally a more persistent parasite followed its prey, sidling along to the best of its ability, and still holding on when dragged head-long, or circumvented its victim by mounting on its back. Sometimes the thrips, particularly the pupal forms, protected themselves by violently contorting the tips of their abdomen, and in one case one of them was seen to excrete a drop of brownish fluid on the wings of the *Thripoctenus*.

Oviposition, when successful, usually required ten or fifteen minutes, and a half-hour was not uncommon. After this there was

normally a rather long period of sucking the wound, followed occasionally by a second oviposition. This last, however, was seldom allowed to occur, as I desired to obtain as many parasitized thrips as possible, and usually replaced the infested individuals with fresh ones. There was no particular point selected for attack, though the abdomen was more often pierced than the thorax. In the length of time required for oviposition the species differs markedly from *T. russelli*, which is described as taking less than a minute for the process. The subsequent tasting of the wound appears also to be omitted by the latter species.

The number of larvæ which a parasite would attack was not definitely ascertained. After attacking three or four the female *Thripoctenus* usually died or made its escape. Those that had already oviposited could be counted upon for a repetition of the process more surely than those which had not so far attempted it.

All stages of the thrips except the adult are attacked, the newly-hatched larvæ with an alacrity which appears to be ill-judged, as the larvæ of the parasite can hardly develop in them properly, the pupæ with a reluctance which may be well-founded. At least one pupa transformed after a *Thripoctenus* had oviposited in it.

Development of the Larvæ: The lengths of the egg and larval stages of the parasite were not determined. It seemed impossible to keep the larval thrips alive after removal from the galls, and moreover, individuals oviposited in under laboratory conditions often proved to have been previously infested. The only method of avoiding this source of error was to raise the hosts from the egg, and this could not be managed. Only occasionally were parasite larvæ obtained by dissection. These were extremely delicate in the early stages. One well-grown specimen, dissected from a pupal thrips, resembled the mature forms, being quite smooth, very faintly segmented, and without any pigmentation in the head.

Parasitization was not obvious until it had reached an advanced stage. At this time the host larva grew mottled and waxy in color, the body was much swollen, and the insect was perfectly torpid, if not dead. In a day or two the outlines of the parasites showed beneath its skin. Owing to the large size of the host, successful multiple parasitism is possible, and indeed appears to be the rule. The plate shows a thrips containing three larvæ, and judg-

ing from the groups of pupæ found, even more may complete their development in a single host. This is impossible with the smaller hosts of *T. russelli*. The larvæ are always oriented in the same direction, their heads towards that of the thrips. The skin of the latter soon splits and shrivels to a small pad, to which the larvæ remain attached until they pupate. As in the case of *russelli* the contents of the alimentary canal are retained until after the insect has completed its transformation. This substance, bright crimson at first, loses its color shortly before the pupal stage, and is voided by the adult as a milky fluid.

In a few cases the length of the pupal stage was determined. Five larvæ developed from two thrips (three in one, and two in the other) began to darken on August 31. The first three were completely black by next day, the other two twenty-four hours later. On the 11th of September four of the five pupæ (all of the first lot and one of the other) hatched. Two were males and two females. The last pupa, a female, hatched on the 13th.

Adult: Perhaps the most striking difference between *nubipennis* and the Western species consists in the presence of males in the former. *Thripoctenus russelli* was found to be both parthenogenetic and thelytokous, no males being produced through all the generations that were reared. In *nubipennis* the male is not uncommon, though slightly rarer than the female. Copulation was observed on more than one occasion. It is a process of very brief duration.

The sex of the offspring of unfertilized females could not be determined, owing to the aforementioned difficulty in keeping the thrips alive.

The adults ran about actively but were not observed to fly, and seldom jumped. They did not feed when offered syrup, but the females were fairly well supplied with the juices of the thrips. Those that oviposited frequently survived the others, but four or five days was about the maximum length of life under laboratory conditions.

The presence of a member of this genus in the Eastern States is probably of no economic importance, since the thrips upon which it preys are not injurious. They belong to a different suborder from the hosts of the two species of *Thripoctenus* hitherto described. Whether or not *nubipennis* would attack members of

the Terebrantia could not be determined for lack of material, but the great difference in habit renders it unlikely that it would do so under natural conditions.

Acknowledgments.

My thanks are due Professor Brues for aid in classifying the parasites and for suggestions and references of all kinds during the course of the experiment. To Dr. Hood I am indebted not only for the determination of the hosts as mentioned above, but also for information about their life-history and for references on the parasite. Much use has been made of Mr. Russell's bulletin for purposes of comparison.

References.

- Howard, L. O. Report of the Entomologist for 1911, U. S. Dept. of Agriculture.
- Crawford, J. C. Proceedings of the Entomological Society of Washington, Vol. XIII, p. 233. *Ibid.*, pp. 235-238.
- Russell, H. M. Bull. Bur. Entom. U. S. Dept. Agric., Technical Series, No. 23.
- Hood, J. D. Canadian Entomologist, Sept., 1908.